

CERTIFICATE OF MAILING BY EXPRESS MAIL

"EXPRESS MAIL" Mailing Label No.  
EL 524 961 655 US . . . . .  
Date of Deposit October 31, 2000 . .  
I hereby certify that this paper or fee  
is being deposited with the U.S. Postal  
Service "Express Mail Post Office to  
Addressee" service under 37 CFR 1.10 on  
the date indicated above and is  
addressed to the Assistant Commissioner  
for Patents, Box Patent Application,  
Washington, D.C. 20231

Type or Print Name Carolyn Bova . . . . .

Signature

*Carolyn Bova*

POSITIONING APPLICATIONS FOR AN ELECTRONIC READING DEVICE

REFERENCE TO EARLIER FILED PROVISIONAL APPLICATIONS

This patent application claims the benefit of  
priority from, and incorporates by reference the entire  
disclosure of, co-pending U.S. Provisional Patent  
Application Serial Nos. 60/182,742, filed on February 16,  
2000, 60/190,343, filed on March 16, 2000, and 60/192,662,  
filed on March 28, 2000.

CROSS REFERENCE TO RELATED APPLICATION

The present application for patent is related to and  
hereby incorporates by reference the subject matter  
disclosed in U.S. Patent Application Serial Nos.

0070441-1000000

10

INS  
SL

0920431-103100

\_\_\_\_\_ (Attorney Docket No.34650-566PT),  
entitled "Specially Formatted Paper Based Applications of  
a Mobile Phone"; \_\_\_\_\_ (Attorney Docket  
No.34650-569PT), entitled "Method and System for Using an  
5 Electronic Reading Device as a General Application Input  
and Navigation Interface"; \_\_\_\_\_ (Attorney  
Docket No.34650-578PT), entitled "Predefined Electronic  
Pen Applications in Specially Formatted Paper";  
\_\_\_\_\_ (Attorney Docket No. 34650-579PT),  
10 entitled "A System and Method for Operating an Electronic  
Reading Device User Interface"; \_\_\_\_\_  
(Attorney Docket No. 34650-601PT), entitled "Method and  
System for Using an Electronic Reading Device on Non-paper  
Devices"; \_\_\_\_\_ (Attorney Docket No. 34650-  
15 602PT), entitled "Multi-layer Reading Device";  
\_\_\_\_\_ (Attorney Docket No. 34650-604PT),  
entitled, "Method and System for Configuring and Unlocking  
an Electronic Reading Device"; \_\_\_\_\_ (Attorney  
Docket No. 34650-606PT), entitled "Printer Pen";  
20 \_\_\_\_\_ (Attorney Docket No. 34650-607PT),  
entitled "Method and System for Electronically Recording  
Transactions and Performing Security Function";

3

## BACKGROUND OF THE INVENTION

### Technical Field of the Invention

The present invention relates in general to the communications field, and in particular to an interaction  
5 of an electronic reading device with an address pattern.

### Description of Related Art

0070441-103100  
Numerous devices exist for accepting user input and controlling user interaction with desktop and portable computers, personal digital assistance (PDAs), mobile  
10 phones, and other types of electronic devices. For example, a keyboard can be used to accept typed input and other types of commands, a mouse or a track-ball can be used to provide relative motion input as well as various types of point-and-click selections, a keypad can be used  
15 to provide input of numerical data and functional commands, navigational keys can be used for scrolling lists or otherwise repositioning a cursor, and various types of touchpads or touchscreens can be used to provide absolute positional coordinate inputs. Each type of  
20 mechanism for accepting input and for supporting user interaction has benefits and disadvantages in terms of

size, convenience, flexibility, responsiveness, and easy  
of use. Generally, the selection of a particular type of  
input mechanism is dependent upon the function of the  
application and the degree and type of interaction  
5 required.

With the ever expanding capabilities and availability  
of applications both on the Internet and the area of  
wireless technology, there continues to be a need to  
develop and provide new mechanisms for accepting input and  
10 interacting with users. In particular, some of the  
existing technologies suffer from drawbacks or  
limitations, such as size and flexibility, that make them  
impractical and/or inconvenient to use in some situations.  
By expanding the range of mechanisms for supporting user  
15 interaction, application developers and end-users can have  
greater flexibility in the selection of input devices.  
Preferably, any such new mechanisms will provide increased  
flexibility and will maximize user convenience. In  
addition, the development of new mechanisms for  
20 interacting with users can expand the realm of potential  
applications.

For example, while a keyboard typically provides a great deal of flexibility, particularly when it is used in connection with a mouse, a touchscreen, or other navigational device, its size makes it inconvenient in many cases, especially in the wireless context.

#### SUMMARY OF THE INVENTION

The present invention comprises a method and system for retrieving position-related information. Initially, a geographical area of any size (e.g., ranging anywhere from within a single building to worldwide) is assigned a corresponding address pattern space such that each unique position of the address space corresponds to a particular geographical position. A map that represents a geographical region can then be generated on a surface that includes a corresponding portion of the address space. Such a map can be used to retrieve information about locations on the map. Alternatively, a portion of the address pattern can be placed at a corresponding geographical location to enable a user to retrieve an identification or other information about the location. In either case, an electronic reading device can be used

to detect positions on the address pattern, and a server  
that includes an address space database can identify the  
corresponding geographical location. This information can  
then be stored or used to retrieve additional information  
5 relating to the identified location.

In one embodiment of the invention, a user of the  
electronic reading device selects an origination location  
and a destination location on a map. The server returns a  
route description, distance, and/or direction from the  
10 origination location to the destination location.  
Furthermore, the server can optionally recommend a mode of  
transportation or generate the route description in  
accordance with a selected mode of transportation. In one  
alternative, instead of selecting an origination location,  
15 an electronic device associated with the electronic  
reading device detects a current position using a  
positioning service, such as the global positioning system  
(GPS). The route description or other information is then  
generated from the current position to the destination  
20 location.

In another embodiment of the invention, a user of the  
electronic reading device selects a position, route, or

Preferably, the user, in addition to selecting position,  
selects certain types of facilities that are of interest,  
5 and the list of facilities is generated in accordance with  
the user selection.

In yet another embodiment, the user touches the electronic reading device to a portion of the address pattern at a particular location to retrieve a location description, to confirm the user's location, or to inform the server of the user's current location.

For a more complete understanding of the present invention, reference is made to the following detailed description taken in conjunction with the accompanying drawings wherein:

FIGURE 2 is a schematic diagram of a system for  
20 supporting use of the electronic pen described in  
connection with FIGURE 1;



FIGURE 3 is an illustration of the protocol stacks that can be used in the case of local communications between an electronic pen and an electronic pen client;

FIGURE 4 is an illustration of protocol stacks that  
5 can be used when an electronic pen and an electronic pen client communicate with one another via an Internet connection;

FIGURE 5 is an illustration of a protocol stack for communications between an electronic pen client and each  
10 of the supporting entities when the electronic pen client is not located within a server on the Internet;

FIGURE 6 is an illustration of protocol stacks that are used for communications between an electronic pen client and each of the supporting entities when the  
15 electronic pen client is located on the Internet;

FIGURE 7 is a block diagram of the electronic pen logic that handles positions, strokes, actions, and grid descriptions;

FIGURE 8 is a block diagram of a state machine for  
20 the electronic pen control block shown in FIGURE 7;

FIGURE 9 is a block diagram of a state machine for an electronic pen client;

FIGURES 10A-10C are a message flow and signaling diagram illustrating the operation of the electronic pen system shown and discussed in connection with FIGURE 2; and

5           FIGURE 11 is a schematic diagram of an electronic pen positioning system in accordance with a preferred embodiment of the present invention.

#### DETAILED DESCRIPTION OF THE INVENTION

00707 "T34E0260

10           The present invention relates to a system in which an electronic reading device, such as an electronic pen, an electronic mouse, or a hand scanner, works in cooperation with an address pattern (e.g., a specially formatted paper) to provide for a detection of a location of the electronic reading device over the address pattern. For

15           instance, a pattern of dots can be defined such that, by examining a very small portion of the pattern, a precise location in the overall pattern can be determined. In fact, it is possible to define a pattern that has the size of 73,000,000,000,000 A4 pages, which is equivalent to

20           half the size of the entire United States. Portions of the pattern can be placed on sheets of paper or other objects.

Then, using an electronic scanner pen that can detect the dots in the pattern, it is possible to detect the location of the pen with respect to the unique pattern. For example, when such a pen is used in connection with a specially formatted paper, the pen can detect its position (e.g., using a built in camera) by detecting a 3 mm by 3 mm portion of the pattern. By taking approximately 100 pictures per second, the pen is capable of determining its exact position to within 0.1 mm or less. This system can be used to provide user input, to facilitate user interaction, or to store handwritten notes or drawings. Moreover, by associating portions of the overall pattern with certain applications, such a system can be used to interact with wide variety of applications.

Referring now to FIGURE 1, there is illustrated an example of a system 2 in which an electronic pen 10 can be used as an input device. The electronic pen 10 includes an ink cartridge and is capable of writing in a typical fashion. The electronic pen 10, however, includes some type of sensor (e.g., a built-in camera) that is used for detecting an address pattern on a specially formatted piece of paper 12. In particular, the paper 12 is

formatted with a small portion of a large address pattern such that when the electronic pen 10 is used to write on or otherwise make marks on the paper 12, the writings or markings can be electronically detected and stored.

5           As an example, the paper 12 might constitute a form that can be used for sending an email. Thus, the paper 12 might include a space for writing in the email address of an intended recipient, a space for writing a subject of the email, and a space for writing the body of the email.

10       As the electronic pen 10 is used to fill in each of the spaces, the position and movement of the electronic pen 10 on the paper 12 can be determined by repeatedly detecting the current x, y coordinates of the pen 10 (e.g., at rate of 100 frames per second). The markings can then be

15       converted into ASCII text using an appropriate handwriting recognition program. Once the user completes the form, the email can be sent, for example, by checking a send box at a predetermined location on the paper 12.

          Preferably, the coordinate information collected by

20       the pen 10 is sent by a short range radio transmitter in the electronic pen 10 to a nearby mobile station 14 using a short range radio interface 16 such as a local wireless

radio link (e.g., a local wireless radio link supported by Ericsson's Bluetooth™ wireless communications technology). Alternatively, instead of using a mobile station 14, the coordinate information could also be sent to, for

5 instance, a desktop or portable computer, a personal digital assistant (PDA), a television, or a Bluetooth terminal. Moreover, instead of using a local wireless radio link, other types of local wireless links, such as inductive coupling and infrared light; other types of  
10 radio links, such as Global System for Mobile Communication; or wired transmission media, such as a cable can also be used. The information can then be forwarded via an appropriate link, such as a cellular air interface 18, to a base station 20 or other network node.

15 Referring now to FIGURE 2, there is illustrated a schematic diagram of a system 2 for supporting use of the electronic pen 10 described in connection with FIGURE 1. Throughout the subsequent discussion, the system 2 is described primarily in connection with an electronic pen  
20 10. It will be understood, however, that the invention and the underlying system 2 can instead use any type of electronic reading device, such as an electronic pen, an

electronic mouse, or a hand scanner. As shown in FIGURE 2, the system 2 includes six different entities, including the electronic pen 10, electronic pen client 22, a control node 24, a name server 26, a base translator 28, and an application server 30. Although these various devices are described and depicted separately, it is also possible to combine two or more of the entities into the same device (e.g., the electronic pen 10 and electronic pen client 22 can be contained in the same device).

10       The electronic pen 10 is responsible for detecting positions on the address pattern, producing actions, and sending information to the electronic pen client 22. In addition to being able to leave pen markings, some electronic pens can also have the ability to produce other types of output, such as sound, vibration, or flashing lights. The electronic pen 10 includes a memory for storing a current grid, which comprises information relating to an area of the address pattern that is near the most recently detected position of the electronic pen 10. When the electronic pen 10 is loaded with the current grid, it knows what actions to take based on the positions that are read from the address pattern. When the

00703461-103100

electronic pen 10 is first turned on or when it moves to  
an area outside of the current grid, the electronic pen 10  
must first request a new grid description before it can  
continue processing information. In such a situation, the  
5 electronic pen 10 requests a new grid description from the  
electronic pen client 22.

09703481-103100  
The electronic pen client 22 can be located in a  
mobile station 14, in a PDA, in a desktop or portable  
computer, in the electronic pen 10 itself, in a server  
10 somewhere on the Internet, or in another device. The  
electronic pen client 22 serves as the center of  
communications in the overall system 2. In particular,  
the electronic pen client 22 receives new grid requests  
and action requests from the electronic pen 10 and  
15 responds to these requests by contacting an appropriate  
entity within the overall system 2 to properly respond to  
the request from the electronic pen 10. Furthermore, when  
the electronic pen 10 is being used in connection with a  
particular application, the electronic pen client 22 can  
20 store the application and/or any corresponding data  
received from the electronic pen 10 to facilitate  
processing and use of the application.

00703431-103400

The name server 26 is used for translating a detected position on the address pattern into a Uniform Resource Location (URL) associated with that position. Different portions of the address pattern are assigned to different applications. Neither the electronic pen 10 nor the electronic pen client 22, however, is aware of all of the different applications and the particular areas assigned to each application. Thus, when the electronic pen 10 detects a new or unknown position, it forwards the position information to the electronic pen client 22, which in turn sends the information to the name server 26. The name server 26 then identifies an application associated with the received position and retrieves a URL where a description of the particular application can be found. The retrieved URL can then be used by the electronic pen client 22 to retrieve the application description.

As an alternative, the name server 26 can comprise a global name server that keeps track of a location, in the form of URLs to local name servers, where more information can be found about different addresses in the pattern. Similarly, each local name server can use other local name



09703481-103100  
servers to obtain the necessary information, i.e., to  
convert a position into a URL where an application  
description can be found. At the lowest level, the local  
electronic pen client should know all the paper addresses  
5 that are within a specific application or applications.

There are some services that should be available in  
the overall system 2 for which it is inconvenient or not  
feasible to support such services in the electronic pen 10  
or the electronic pen client 22. In such a case, the base  
10 translator 28 can be used to support the services. For  
example, the base translator 28 might contain handwriting  
recognition software for converting pen actions into text  
or for converting pen actions into a predefined set of  
symbols. When such services are needed, the electronic  
15 pen client 22 can send a request to the base translator 28  
along with the necessary data, and the base translator 28  
can perform the requested service.

Another entity in the system 2 is a control node 24.  
The control node 24 is used for responding to actions in a  
20 standardized way. For example, the control node 24 can be  
used to respond to certain generic functions, such as  
"cancel" or "submit" functions, in a consistent manner

without regard to the particular application that is currently active.

In addition, the control node 24 is used for creating streaming-like applications. For instance, some applications might require that the positions on the address pattern that are detected by the electronic pen be immediately sent, upon detection, to the electronic pen client 22 for use by the application (i.e., the electronic pen 10 does not wait to transmit the position data until a complete stroke is detected or until a "send" field is touched). One example is an application that is used to control an industrial robot in a warehouse. In such a case, the application description that is loaded onto the electronic pen server 22 can include instructions that all positions be streamed to a control node 24. As a result, the control node 24 can receive the positions in real time and can control the robot without waiting for the form (i.e., the current grid) to be completed. Thus, the control node 24 can perform a real-time translation from detected positions to a responsive action, such as moving an object (e.g., a robot, a valve, etc.) or controlling a process.

00703481-103100

09703481-103100

The application server 30 is a regular web or wireless application protocol (WAP) server that supports an application associated with a particular area of the address pattern. The application server 30 stores an application description and provides the application description to the electronic pen client 22 upon request. In addition, the application server 30 receives input data from the electronic pen 10 via the electronic pen client 22. For example, the application description might define a number of data entry areas on a form. Thus when data is entered on the form by the electronic pen 10, the data is received by the electronic pen client 22, converted into text using handwriting recognition software, and forwarded to the application server 30, which stores the data or otherwise processes the data in accordance with the function of the application.

Referring now to FIGURES 3 through 6 there are illustrated various examples of protocol stacks that can be used for communicating between the entities shown in FIGURE 2. Generally, however, such protocols apply however, only if the two communicating entities are implemented in different devices. If two or more entities

are combined into one device, a proprietary protocol can be used to communicate between the entities. FIGURE 3 illustrates the protocol stacks that can be used in the case of local communications (e.g., using Bluetooth)

5 between the electronic pen 10 and the electronic pen client 22. If, on the other hand, the electronic pen 10 and the electronic pen client 22 communicate with one another via an Internet connection, the protocol stacks depicted in FIGURE 4 will be used. FIGURE 5 illustrates a

10 protocol stack for communicating between the electronic pen client and each of the supporting entities, such as the name server 26, the control node 24, the base translator 28, and the application server 30, when the electronic pen client 22 is not contained within a server

15 on the Internet (e.g., such as when the electronic pen client 22 is located in a mobile phone 14). Finally, FIGURE 6 depicts the protocol stacks that are used when the electronic pen client 22 is located on the Internet.

There are a number of procedures that can be used by

20 the various entities in the system 2 to allow the system to operate properly. When the electronic pen 10 detects a position on the address pattern that is not within its

In some situations, it may be necessary for the electronic pen 10 to unload its current grid at the

request of the electronic pen client 22. In such a case,  
the electronic pen client 22 sends an empty grid  
description to the electronic pen 10, thereby causing the  
electronic pen 10 to unload its current grid. This can  
5 occur, for example, when a particular application is  
complete or when a new grid description request received  
from the electronic pen 10 cannot be fulfilled, such as  
when the position received from the electronic pen 10 is  
not registered in the name server 26.

10 Another similar message is the empty grid description  
with a grid exception. When the electronic pen 10  
requests a new grid description from the electronic pen  
client 22, the electronic pen client 22 uses the detected  
position specified in the request to ask the name server  
15 26 for a URL where the application description can be  
found. If no URL is returned, the electronic pen client  
22 can send an empty grid description with a grid  
exception to the electronic pen 10. The grid exception  
comprises a rectangle or other shape indicating the area  
20 around the detected position where no registered  
applications can be found. Preferably, the indicated area  
is as large as possible so that the electronic pen 10

and/or electronic pen client 22 know the extent of the surrounding area that is unassigned and do not have to repeatedly send requests to the name server 26. Thus, the empty grid description with a grid exception causes the  
5 electronic pen 10 to unload its current grid and also informs the electronic pen 10 of an area surrounding the detected position that can essentially be ignored because its is not associated with any application.

The procedure that is used when the electronic pen 10  
10 detects a new position is a find application description location procedure. This procedure is used by the electronic pen client 22 to translate a detected position received from the electronic pen 10 into a URL where a description of an application corresponding to that  
15 position can be found. The procedure involves sending a request from the electronic pen client 22 to the name server 26 containing identification of the detected position. The name server 26 responds by sending a reply to the electronic pen client 22 containing a URL where an  
20 application description can be found or, if the detected position is not registered in the name server 26,

containing an indication that no associated application is known to exist.

Once the electronic pen client 22 knows the URL where an application description can be found, the electronic pen client 22 can initiate a get application description procedure, which allows the electronic pen client 22 to retrieve the application description from the application server 30. In particular, the electronic pen client 22 sends an application description request containing a unique ID for the requesting electronic pen 10 and/or electronic pen client 22 to the application server 30 located at the URL address provided by the name server 26. In response, the application server 30 provides an application description object to the electronic pen client 22, which loads the application onto the electronic pen client 22. The application description object is similar to an HTML form with some additions and modifications.

Furthermore, the application description object can be sent from the application server 30 to the electronic pen client 22 in response to a submitted form (i.e., a submission of one completed form might automatically



00100103431-10343100

result in a new form being loaded onto the electronic pen client 22). A related procedure is the application submit procedure, which is used by the electronic pen client 22 when the user of the electronic pen 10 selects a "submit" field in a form. In response to the selection of the "submit" field, the electronic pen client 22 will submit the form content in accordance with instructions received in the application description. Typically, the electronic pen client 22 will submit the form content, in the same way as a regular web browser, to a URL specified in a form tag of the application description.

When an action that can be handled by the electronic pen 10 itself is generated, an action procedure is initiated by the electronic pen 10 to send an action request object to the electronic pen client 22. If the electronic pen client 22 cannot translate the action into a field value itself, the electronic pen client 22 further forwards the request to a base translator 28 for translating the action into a field value. In response to the action request object, an action reply object is sent from the electronic pen client 22 to the electronic pen 10. The action reply object contains output information

that indicates to the electronic pen 10 which outputs  
signals to use. The output information, however, cannot  
be of type that the electronic pen 10 has previously  
indicated that it does not support. In some instances, the  
5 action reply object might contain a new grid description.  
In such a case the electronic pen 10 will unload its  
current grid description and load the new grid  
description. Similarly, if the action reply object  
contains an empty grid description, the electronic pen 10  
10 will simply unload its current grid description.

The action request object is also sometimes used to  
specify actions that should be processed by the control  
node 24. In this instance, the electronic pen client 22  
initiates a control procedure by forwarding the received  
15 action to the appropriate control node 24. As a result,  
the control node 24 sends an action reply object to the  
electronic pen client 22.

The operation of the electronic pen 10 will now be  
discussed in greater detail. Each electronic pen 10 has a  
20 unique pen ID, which is sent to the application server 30  
when an application description is requested. The  
electronic pen ID allows the application to identify the

particular user that is using the application and to distinguish between multiple concurrent users of the same application, such as when different electronic pens 10 are being used in connection with separate sheets of paper that each contain the same portion of the address pattern.

Referring now to FIGURE 7, there is illustrated a block diagram of the electronic pen logic that handles positions, strokes, actions, and grid descriptions for the electronic pen 10. The electronic pen 10 includes a control block 32 for controlling the operation of the electronic pen 10. A grid description block 34 represents a memory location that stores a current grid description. At any given time, the electronic pen 10 can be in either of two modes. In a first mode, a grid description is loaded, while in a second mode, the grid description block 34 is not loaded with a current grid description.

As the electronic pen 10 moves across an address pattern, the electronic pen 10 periodically (e.g., every 1/100 of a second) detects a position by detecting all of the dots within, for example, a 3mm by 3mm area. Each detected position is forwarded (as indicated at 36) to a position first in first out (FIFO) block 38, which acts as

a buffer for temporarily storing the detected positions.  
The clocking of the position FIFO block 38 is controlled  
by the control block 32 (as indicated at 40).

00703431-103400  
The detected position is fed from the position FIFO  
5 block 38 (as indicated at 42) to an in grid detector 44.  
The in grid detector 44 retrieves data from the grid  
description block 34 (as indicated at 46) and determines  
whether the received position is within the loaded grid  
description. If not, the in grid detector 44 notifies the  
10 control block 32, which in turn initiates a request for a  
new grid. When the detected position is within the  
current grid, the position is then sent (as indicated at  
50) from the in grid detector 44 to a stroke engine 52.  
The stroke engine 52 converts the received positions into  
15 strokes, which are then sent (as indicated at 54) to an  
action engine 56. A complete stroke is created when the  
electronic pen 10 is lifted from the paper or when it  
moves outside of the grid field where the stroke began.  
Finally, the action engine 56 converts the received stroke  
20 into an action that can be sent to the electronic pen  
client 22. By using grid action-field-types, the action

engine knows which type of action to produce for a specific grid field.

Referring now to FIGURE 8, there is illustrated a block diagram of a state machine for the control block 32 shown in FIGURE 7. In this figure, events are indicated in capital letters, while tasks associated with the event are depicted in brackets. The process starts at step 60 with a start up event 62, which causes the position FIFO block 38 to begin receiving detected positions.

Initially, the electronic pen 10 is in a no grid loaded state 64, which means that the electronic pen 10 does not have a grid loaded in the grid description block 34. As a result, the control block 32 generates an outside grid indication 66, thereby causing the electronic pen 10 to send the request for a new grid description to the electronic pen client 22 (i.e., in accordance with the new grid procedure) and to stop the FIFO buffer 38. At this point, the electronic pen 10 enters a waiting for grid state 68.

Once the new grid has been received (as indicated at 70), the control block 32 moves to a grid loaded state 72, at which time the new grid is loaded into the grid

description block 34 and the position FIFO block 38  
resumes operation. On the other hand, if no grid is  
received (as indicated at 74), at least a portion of the  
positions stored in the FIFO buffer 38 are erased. Which  
5 part of the FIFO buffer to erase is determined by the grid  
exception area, if any, in the received empty grid  
description. Accordingly, all positions stored in the  
FIFO buffer 38 that are within the grid exception area  
should be erased. If no grid exception is received, the  
10 stroke associated with the position is erased. In  
addition, the FIFO block 38 resumes operation and the  
control block 32 moves into the no grid loaded state 64.

When the control block 32 is in the grid loaded state  
72, a current grid is loaded in the grid description block  
15 34. While the control block 32 remains in this state 72,  
the position FIFO block 38 continues to receive detected  
positions and passes them on to the stroke engine 52 and  
action engine 56. Actions produced by the action engine  
56 are sent (as indicated at 58) to the electronic pen  
20 client 22 (i.e., in accordance with the action procedure  
described above).

5 electronic pen 10 enters a flushing stroke and action  
state 76 wherein the strokes that are currently in the  
stroke engine 52 and the actions that are currently in the  
action engine 56 are flushed to the electronic pen client  
22. Once the stroke engine 52 and action engine 56 have  
10 been fully flushed (as indicated at 78), the electronic  
pen 10 sends a request for a new grid to the electronic  
pen client 22 and unloads the current grid. The control  
block 32 then moves back into the waiting for grid state  
68.

15           As a general matter, the electronic pen 10 may be  
capable of supporting various different types of output,  
including audio, such as warning tones; visual, such as a  
flashing light; tactile, such as vibration; and/or ink. In  
some cases, it might be desirable to allow the user of the  
20   electronic pen 10 to turn off<sup>12</sup> the ink of the pen 10,  
such as when the electronic pen is being used on a portion  
of the address pattern that is public or shared or when

the user wants to be able to reuse the current sheet of paper.

The electronic pen client 22 will now be described in greater detail. Generally, the electronic pen client 22  
5 is analogous to a regular web browser. It is responsible for loading applications from application servers 30 and for handling input from the electronic pen 10.

Preferably, the electronic pen client 22 is located in a separate device from the electronic pen 10 itself. This  
10 is because it is desirable to minimize the size and power supply requirements of the electronic pen 10, which will likely be adversely affected by the processing resources and memory necessary to support the functions of the electronic pen client 22.

Referring now to FIGURE 9, there is illustrated a  
15 block diagram of a state machine for the electronic pen client 22. Initially, the electronic pen client 22 is in a no application loaded state 80. The electronic pen client 22 recognizes only one signal when in this state  
20 80, namely a new grid request from the electronic pen 10. Such a request causes a load grid indication event 82. The electronic pen client 22 responds by sending a request



to the name server 26 to translate a position contained within the new grid request into a URL where the application description can be found (i.e., in accordance with the find application location procedure). Next, the electronic pen client 22 enters a waiting for application description URL state 84. If no URL for the application description can be found (as indicated at 86), the electronic pen client 22 sends a new grid reply to the electronic pen 10, wherein the reply contains an empty grid description with a grid exception. As a result, the electronic pen client 22 returns to the no application loaded state 80.

If a URL for the application description is received from the name server 26 (as indicated at 88), the electronic pen client 22 sends a request to the application server 30 to retrieve the application description (i.e., in accordance with the get application description procedure). Accordingly, the electronic pen client 22 enters a waiting for application description state 90.

If the electronic pen client 22 does not receive an application description from the application server 30 (as

5     80. If, however, the electronic pen client 22 does  
receive an application description from the application  
server 30 (as indicated at 94), the electronic pen client  
22 sends a new grid reply to the electronic pen 10  
containing a new grid description, and the electronic pen  
10 client 22 loads the application in its memory. In  
addition, the electronic pen client 22 moves into an  
application loaded state 96.

In the application loaded state 96, five types of actions can be received by the electronic pen client 22 from the electronic pen 10. First, a received action can include a request that the electronic pen client 22 cannot handle itself, in which case the electronic pen client 22 will send the action to the base translator 28 (as indicated at 98). The electronic pen client 22 then moves into a waiting for response from the base translator state 100. Once a base translator response 102 is received by the electronic pen client 22, the electronic pen client 22

Another type of action that the electronic pen client 22 can receive from the electronic pen 10 is a request that should be forwarded to a control node 24. In such a case, the action is sent to a control URL specified in the application description (as indicated at 104), and the electronic pen client 22 enters a waiting for response from the control state 106. Once a response is received from the control (as indicated at 108), the electronic pen client 22 sends an action reply to the electronic pen 10 with appropriate output information.

09703481-103400  
application is unloaded from the electronic pen client 22  
and an action reply is sent to the electronic pen 10 with  
an empty grid. As a result, the electronic pen client 22  
returns to the no application loaded state 80. On the  
5 other hand, if the application server 30 responds with a  
non-empty application description, the old application is  
unloaded from the electronic pen client 22, the new  
application description is parsed and loaded in the  
electronic pen client 22, an action reply is sent to the  
10 electronic pen 10 with a new grid description and with  
appropriate output information, and finally the electronic  
pen client 22 returns to the application loaded state 96.

A fourth type of action that can be received by the  
electronic pen client 22 from the electronic pen 10 is a  
15 request to load a new grid. This action occurs, for  
example, when a position outside of the current grid is  
detected by the electronic pen 10. When a new grid  
request is received, the electronic pen client 22 sends a  
request to the name server 26 (as indicated at 116) and  
20 the electronic pen client 22 returns to the waiting for  
application description URL state 84.

00703481-103100

Finally, a fifth type of action that can be received by the electronic pen client 22 is an action that the electronic pen client 22 can handle itself, in which case the electronic pen client 22 updates the current form and sends an action reply to the electronic pen 10 with appropriate output information (as indicated at 118). The electronic pen client 22 then remains in the application loaded state 96. One type of action that the electronic pen client 22 might be able to handle itself is a local application. For example, the electronic pen client 22 might be capable of performing certain basic functions that are defined by a local application. Thus, when the electronic pen client 22 receives a new grid request, the position associated with the new grid request can be analyzed to determine if it corresponds to a local application. If so, the electronic pen client 22 can load the application description from its local memory, send a new grid description to the electronic pen 10 without having to communicate with the name server 26 or the application server 30.

Another action that might be handled locally by the electronic pen client 22 relates to the selection of

fields within a form. When the electronic pen client 22 receives an action, the field that corresponds to that action receives focus. When this occurs, the electronic pen client 22 might display the field's value on its display or output the value by audio. In addition, the electronic pen client 22 might allow the user to edit the value of the field by means other than the electronic pen 10. Yet another type of action that might be handled by the electronic pen client 22 itself are actions that relate to a clipboard function. When a "copy" field is selected, the value of the field that had focus at the time the copy field was selected is transferred to the clipboard. Similarly, when a "paste" field is selected, the value stored in the clipboard is transferred to the field that had focus at the time the paste field was selected.

Referring now to FIGURES 10A through 10C, there is shown, by way of example, a message flow and signaling diagram illustrating the operation of the electronic pen system 2 depicted in and discussed in connection with FIGURE 2. Initially, the electronic pen 10 detects a first position on the address pattern at step 120 (e.g.,

at a location on a sheet of paper designated for composing  
and sending emails). At this stage, it is assumed that  
the electronic pen 10 is in a no grid loaded state. Thus,  
in response to the detection of the first position, the  
5 electronic pen 10 sends a new grid request 122, which  
contains the detected position information, to the  
electronic pen client 22. As a result, the electronic pen  
client 22 sends an application location request 124  
containing the detected position information to the name  
10 server 26, at step 126. The name server 26 translates the  
detected position into a URL where an application  
description that corresponds to the detected position can  
be found (e.g., a URL address for a server containing an  
email application), and returns an application location  
15 reply 128 containing the retrieved URL to the electronic  
pen client 22.

The electronic pen client 22 then sends an  
application description request 130, which contains the  
unique pen ID for the electronic pen 10, to the  
20 application server 30. The application server 30  
retrieves the application description at step 132 and  
sends an application description reply 134 containing the

retrieved application description to the electronic pen client 22. The electronic pen client 22 then parses and stores the application description at step 136. This step further involves generating a current grid description from the application description and sending the grid description to the electronic pen 10 in a new grid reply 138. The electronic pen 10 stores the received grid description at step 140 and resumes processing of the detected positions. Using the detected positions and the information in the grid description (e.g., so that the electronic pen 10 knows which fields of the email form are being filled in), the electronic pen 10 generates strokes at step 142 and generates actions at step 144 using the stroke engine 52 and action engine 56 shown in FIGURE 7.

Each time an action is generated that cannot be handled by the electronic pen 10 itself, an action request 146 containing a description of the action is sent from the electronic pen 10 to the electronic pen client 22. At this point, the electronic pen client 22 should determine what type of action has been received so that it can respond to the action in an appropriate manner. First, it is determined whether the action requires the attention



of, or otherwise should be processed in accordance with, a  
local application at step 148. Very basic applications or  
frequently used applications (e.g., delete entered text),  
for example, might be stored locally to avoid having to  
5 contact another entity. In such a case, the electronic  
pen client 22 retrieves the local application at step 150  
and sends an action reply 152, which can contain a new  
grid description or other appropriate information.

However, if it is determined at step 148 that the  
10 received action does not relate to a local application,  
the process continues at step 154 where it is determined  
whether the received action requires processing by an  
external translator (e.g., handwriting recognition). If  
so, an action request 156 containing a description of the  
15 action is sent by the electronic pen client 22 to the base  
translator 28. The base translator 28 processes the  
action at step 158 and sends an action reply 160  
containing output information responsive to the received  
action (e.g., text corresponding to written characters) to  
20 the electronic pen client 22, which can forward the output  
information to the electronic pen 10 in an action reply  
162, if necessary.

001001 "T84E0260

If it is determined at step 154 that the received action does not require processing by an external translator, it is next determined whether the action relates to a control application at step 164. If so, an action request 166 containing a description of the action is sent by the electronic pen client 22 to the control server 24. The control server 24 processes the received action at step 168 and, if a response is necessary, returns output information responsive to the received action in an action reply 170, which is forwarded from the electronic pen client 22 to the electronic pen 10 in an action reply 172.

Assuming that it is determined at step 164 that the received action does not relate to a control function, it is next determined whether the action comprises a request to submit a form at step 174 (e.g., a selection of a "send" area on the email form). If so, an action request 176 containing the data entered onto the form is sent by the electronic pen client 22 to the application server 30. The application server 30 processes the form at step 178 and sends an action reply 180 containing a new application description (or an empty application description) to the

10

15

Another possibility is that the name server 26 determines at step 192 that a URL corresponding to the detected position is not available. In this situation,

the name server 26 sends an application location reply 208 to the electronic pen client 22. The reply 208 may simply be empty to indicate that a URL is not available.

Preferably, however, the reply 208 contains a grid

5 exception defining the largest area possible around the detected position for which there is no corresponding URL. In response to the reply 208, the electronic pen client 22 sends a new grid reply 210 containing an empty grid description with a grid exception. Upon receiving the  
10 reply 210, the electronic pen 10 unloads the current grid description at step 212. Furthermore, assuming that the electronic pen 10 receives and recognizes the grid exception information, the electronic pen 10 may subsequently be able to determine that certain detected  
15 positions on the address pattern are not associated with any application without having to send a request to the name server 26 or the application server 30.

In accordance with the present invention, the electronic pen system 2 can be used for a variety of  
20 different positioning applications. In particular, by pointing at a location or area on a map with the electronic pen 10, a user can obtain, for example, a route

description from a selected or current position to a destination, distance and direction information from a selected or current position to a destination, and/or information about facilities near a selected position or  
5 within a selected area. In addition, by pointing the electronic pen 10 at a surface that includes a preselected portion of the address pattern, a user can obtain information identifying the user's current location and/or a confirmation of the user's current position can be sent  
10 to the system 2. The use of such positioning applications can be facilitated by defining a universal global addressing scheme wherein a specific location on the address pattern is associated with a particular geographical position. Thus, every geographical position  
15 in the entire world would have an associated position on the address pattern. In addition, more than one universal addressing scheme can be defined to support maps of different scales. Such schemes would enable maps to easily be printed on addressed paper using the correct  
20 address space.

Referring now to FIGURE 11, there is illustrated a schematic diagram of an electronic pen positioning system

09703481-103100  
220 in accordance with a preferred embodiment of the  
present invention. In one embodiment, a map or boat chart  
is printed on a specially formatted paper 222 that  
includes a unique portion of the address pattern, wherein  
5 each geographical position on the map can be identified by  
detecting a small area of the address pattern at and  
around the particular geographical position. To obtain a  
route description, for example, the user points the  
electronic reading device 10 at a current or selected  
10 originating position 224. Next, the user points the  
electronic reading device 10 at a selected destination  
position 226. The electronic reading device 10 transmits  
the detected positions 224 and 226 to the user's mobile  
station 14 or other client device 22 via a Bluetooth™  
15 radio interface 16.

The mobile station 14 identifies a map server 232  
that is associated with the addressed area on the  
formatted paper 222 using the same type of procedure as  
described above (i.e., the procedure used to identify an  
20 application server 30). The mobile station 14 then sends  
the position information 224 and 226 to the map server 232  
by transmitting the information via a radio interface 18

to a base station 20, which forwards the information over a general packet radio service (GPRS) network 228 and an IP network 230 to the map server 232.

09703481-103100  
In response, the map server 232 generates a route  
5 description from the origination position 224 to the destination position 226 and sends the route description back to the mobile station 14 or other client device 22, which then displays the route description on a display screen 234. The route description can be displayed in the  
10 form of simple text, graphics, or a combination of both. Furthermore, in addition to or instead of obtaining a route description, the map server 232 might also be able to provide other information, such as the distance and/or compass direction from the current or originating position  
15 224 to the destination position 226. Preferably, the mobile station 14 or client device 22 includes a web browser or a wireless application protocol (WAP) browser to retrieve and display the information.

Alternatively, the user can trace a route with the  
20 electronic reading device 10, and the map server 232 then generates a textual description of the route (i.e., street names, driving directions, and the like) and/or determines



distances between an originating position and a destination position or between any other two locations along the route.

As another alternative, instead of selecting both an  
5 originating position 224 and a destination position 226,  
the mobile station 14 or client device 22 can support some  
type of positioning service, such as the global  
positioning system (GPS) or observed time difference  
(OTD). In such a case, the user only needs to select a  
10 destination position 226 with the electronic reading  
device 10 because the mobile station 14 or other client  
device 22 can determine a current position, using the  
positioning service, and forward the current position  
along with the selected destination position 226 to the  
15 map server 232.

In another variation, the map server 232 can also  
suggest a specific means of transport (e.g., bus, train,  
walk, car, etc.) based on distance, convenience, and the  
like. In yet another variation, the user can request a  
20 route description from a current or selected originating  
position 224 to a destination position 226 using one or  
more specified means of transport. For example, the user

09703481.103100

can specify one or more particular means of transport by touching the electronic reading device 10 to predefined areas on the formatted paper 222 that each correspond to a particular means of transport (e.g., one field on the formatted paper 222 corresponds to bus transportation, another field corresponds to train transportation, etc.).

In another embodiment of the invention, a user of the electronic reading device 10 can obtain information about facilities near a selected position or within a selected area. In particular, the user first selects a particular location by touching the electronic reading device 10 to the location or selects an area by using the electronic reading device 10 to draw a circle, box, or any other figure with joining ends on a map that is printed on specially formatted paper 222. The user would then use the electronic reading device 10 to check one or more boxes indicating what information (e.g., restaurants, hotels, tourist information offices, tourist attractions, toilets, etc.) is requested. Finally, the user would check a "Give Me Information" box field, which would cause a request for information to be sent to the map server 232. A result generated by the map server 232 would then

be shown on the display screen 234 of the mobile station  
14 or other client device 22 in the form of simple text,  
graphics, or a combination of both. Again, the mobile  
station 14 or client device 22 would preferably use a web  
5 browser or WAP browser to display the information.

Alternatively, the user could simply draw a line  
designating a route and then check one or more check  
boxes, indicating what information is desired, to obtain  
information about facilities along the route. In  
10 addition, such a request for facilities information can be  
combined with the prior route description application to  
obtain information about selected types of facilities  
along a route description generated by the map server 232.

In another embodiment of the invention, a positioning  
15 system 220 can be used in connection with location based  
services. For example, by using the electronic reading  
device 10 to touch or draw on a piece of paper 222 or  
other formatted surface placed at a certain position  
(e.g., at a tourist information center, rest stop along a  
20 highway, or at a particular building), a user can be  
informed of his or her current position. Furthermore, the  
system 220 can also be informed of the specific user's

current position. Such information can be used by the system 220 to store position and time of arrival information or to grant access to a building. Moreover, by requiring a user's signature in connection with a request for building access, the user's identity can also be authenticated.

In accordance with the preferred embodiment, the address space on which maps are printed is predefined in such a way that particular locations on the address pattern directly correspond to specific geographical positions. By printing a map on an appropriate portion of the address space, locations on the map can be automatically associated with the corresponding geographical positions.

Although various preferred embodiments of the method and apparatus of the present invention have been illustrated in the accompanying Drawings and described in the foregoing Detailed Description, it is understood that the invention is not limited to the embodiments disclosed, but is capable of numerous rearrangements, modifications, and substitutions without departing from the spirit of the invention as set forth and defined by the following

claims. Furthermore, it shall be understood that the terms "comprises" and "comprising," when used in the foregoing Detailed Description and the following claims, specifies the presence of stated features, elements, 5 steps, or components but does not preclude the presence or addition of one or more other features, elements, steps, components, or groups thereof.

09703481-103100